

# Characteristics of materials and thermal treatments applied to gearwheels obtained by plastic deformation

I Bostan<sup>1</sup>, V Dulgheru<sup>1</sup> and N Trifan<sup>1</sup>

<sup>1</sup>Fundamentals of Machines Design Department, Technical University Moldova, Chişinău, Rep. Moldova

E-mail: trifan@mail.utm.md

**Abstract.** A variety of materials are used in the manufacture of gearwheels. These materials satisfy various working conditions for gears. Such gears are made of metallic materials – ferrous, non-ferrous and from plastic materials. Among ferrous materials the following are used: irons; cast, forged and rolled steels; among non-ferrous materials the following are used: bronze, aluminium alloys, brass, etc., and of plastics the following are used: textolite, polyamide, polyacetal. In the practice of exploitation and in the process of special research it was established that the permissible load, according to teeth contact resistance, is generally determined by the hardness of the material. The highest hardness and respectively, the smallest sizes and reduced mass of the transmission can be obtained in the manufacture of steel gears via thermal treatment. It is obvious that by plastic deformation at cold it cannot be obtained gearwheels with complicated configuration as deformed plastic metal will form cracks caused by low plasticity. To improve processability by plastic deformation the mouldings for gearwheels are heated. With increasing the heating temperature, plasticity increases and resistance to deformation decreases.

## 1. Introduction

The often ferrous materials used is irons, castings, forgings and rolled steel, the often nonferrous materials used is bronze, aluminum alloys, brass etc. and most plastics materials used is - hard plastics, nylon, polyacetal [1]. In exploitation practice and through special research it was established that the permissible contact resistance load of teeth is usually determined by the hardness of the material. The highest hardness, respectively, the smallest clearances and reduced mass transmission can be obtained by using gears from heat treatment steel.

At the present steel is the basic material for the manufacture of gears and, in particular, of the transmission power gears.

Recommended steels for gears, types of thermal and thermo-chemical and mechanical characteristics are shown in table 1 [1, 2]. Materials used for gears manufacturing by cold or hot pressing must provide: strength, hardness, rigidity and minimum weight appropriate to the lowest possible cost and possess plastic forming. On cold or hot plastic deformation the cost of labor is quite low - 60 ... 80% of product cost, essentially formed by material cost [3]. With this method can be processed following metallic materials (steel, copper and its alloys, aluminum and its alloys) and nonmetallic materials (textolit, plastics, organic glass). Figure 1 presents graphs influence on cold plastic deformation plasticity  $\delta$ , limit of tensile strength  $\sigma_r$ , hardness HB for a low carbon steel. To improve processability using plastic deformation gear preforms are heated. With the increase in the

